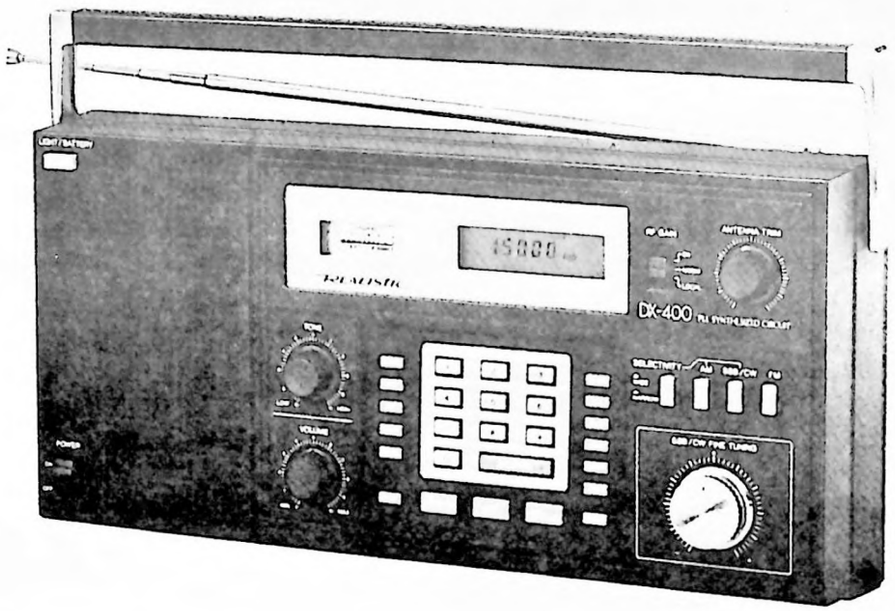
PLL (Phase Lock Loop) Synthesized Communication Receiver



DX-400

OWNER'S MANUAL

PLEASE READ BEFORE USING THIS EQUIPMENT

REALISTIC®

CAT. NO.
20-207

CUSTOM MANUFACTURED FOR RADIO SHACK, A DIVISION OF TANDY CORPORATION

CAUTION

RISK OF ELECTRIC SHOCK DO NOT OPEN

CAUTION: TO REDUCE THE RISK OF ELECTRIC SHOCK. DO NOT REMOVE COVER (OR BACK). NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL.

The lightning flash with arrowhead, within an equilateral triangle, is intended to alert the user of the presence of uninsulated "dangerous voltage" within the product's enclosure that may be of sufficient magnitude to constitute a risk of electric shock to persons.

The exclamation point within the equilateral triangle is intended to alert the user of the presence of important operating and maintenance (servicing) instructions in the literature accompanying the appliance.

WARNING: To prevent fire or shock hazard, do not expose this Receiver to rain or moisture.

. . . It all comes alive on your Realistic DX-400 Programmable Communication Receiver.

Your DX-400 will put you in contact with a variety of voices around the world. Broadcasts can be heard from such world capitals as London, Tokyo, Paris, Berlin and Moscow. Exotic music and unusual languages can be heard from stations located in distant, isolated sections of the world. We recommend that you read through this instruction manual carefully to utilize this microprocessor-controlled Programmable Communication Receiver to its maximum potential.

Your DX-400 is designed to tune in the following frequencies:

FM: 87.4 MHz to 108 MHz
AM/SSB/CW: 150 kHz to 29,999 kHz

The PLL(Phase Locked Loop) circuitry assures ultra-precise frequency control. This enables the radio to tune in increments of 1–3 kHz for AM/SSB/CW and 50–100 kHz for FM.

Do you want to listen to a particular station? You can enter the desired frequency directly on the keyboard.

Curious about what's on the air? The DX-400 will search frequency ranges of your choice automatically for active stations.

And if you want to remember stations you've found, memories store the frequencies for later use.

The secret to the DX-400 is a custom-designed microprocessor — a computer on a chip! In addition, the DX-400 includes 11 ICs, 62 transistors, 88 diodes and a liquid crystal display.

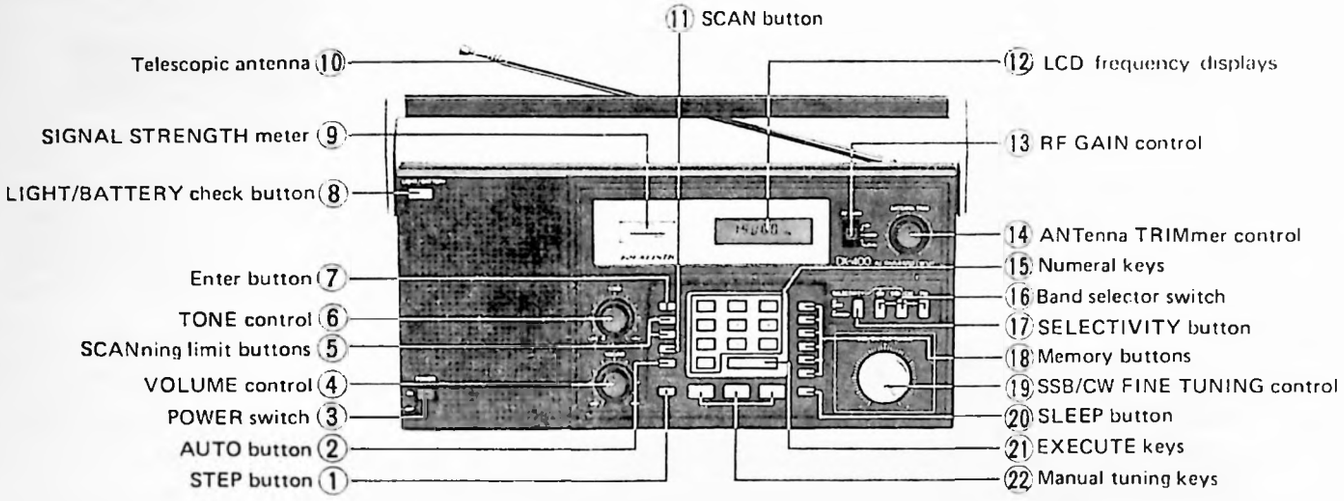
SPECIFICATIONS

Semiconductor Complement:	11 integrated circuits, 3 FET 62 transistors, 88 diodes
Receiving System:	AM: Triple Super Heterodyne FM: Single Super Heterodyne
Frequency Coverage:	150 kHz to 29,999 kHz 87.4 MHz to 108 MHz
Frequency Display:	5 digit LCD (Liquid Crystal Display)

Sensitivity:				
(for 10 dB Signal-to-Noise ratio):	AM	150 kHz	5μV	
		300 kHz	1μV	
		600 kHz	1μV	
		1.4 MHz	1μV	
		3.1 MHz	1μV	
		7.1 MHz	1μV	
		15.1 MHz	1μV	
		28.1 MHz	1μV	
	SSB	150 kHz	5μV	
		300 kHz	5μV	
		600 kHz	0.5μV	
		1.4 MHz	0.5μV	
		3.1 MHz	0.5μV	
		7.1 MHz	0.5μV	
		15.1 MHz	0.5μV	
		28.1 MHz	0.5μV	
(for 30 dB Signal-to-Noise ratio):	FM	87.4 MHz to 108 MHz	5μV	
Image Ratio:	AM/SSB	150 kHz	70 dB	
		300 kHz	70 dB	
		600 kHz	70 dB	
		1.4 MHz	70 dB	
		3.1 MHz	70 dB	
		7.1 MHz	70 dB	
		15.1 MHz	70 dB	
		28.1 MHz	70 dB	
	FM	87.4 MHz to 108 MHz	26 dB	
Selectivity:	AM/SSB		-6 dB	-50 dB
		WIDE	3 kHz	6 kHz
		NARROW	2.5 kHz	5 kHz
Reception Mode:	AM,SSB,CW,FM			
I.F.	AM/SSB/CW	1st	65.150 – 65.050 MHz	
		2nd	10.7 MHz	
		3rd	455 kHz	
	FM		10.7 MHz	
Fine Tuning:	±2.5 kHz			
Frequency Stability:	Within 1 kHz per hour after 60 minutes warm up.			
Audio Output (8 ohms):	1.8 watts maximum			
Antenna:	Bar Antenna .....(Only 360 kHz to 2,199 kHz)			
	Rod Antenna.....(All Frequency Ranges)			
	External Antenna Terminal.....(All Frequency Ranges)			
Power Source:	AC 120 volts, 60 Hz (240 volts, 50 Hz for the units purchased in UK and Australia)			
	Batteries (C cell x 6 pcs)			
	11 to 16 volts DC (EXT DC Jack)			
Crystals:	3 Crystals and 2 Ceramic Resonaters			
Sleep Timer:	10 to 90 minutes/Selectable in ten-minutes steps)			
Dimensions:	6 x 12-3/5 x 2-7/8" HWD (155 x 320 x 73 mm)			
Weight:	4 lbs. (1.75 kg) without batteries			
Accessories:	External Antenna Cable			
	AC Cord			

CONTROLS AND FUNCTIONS

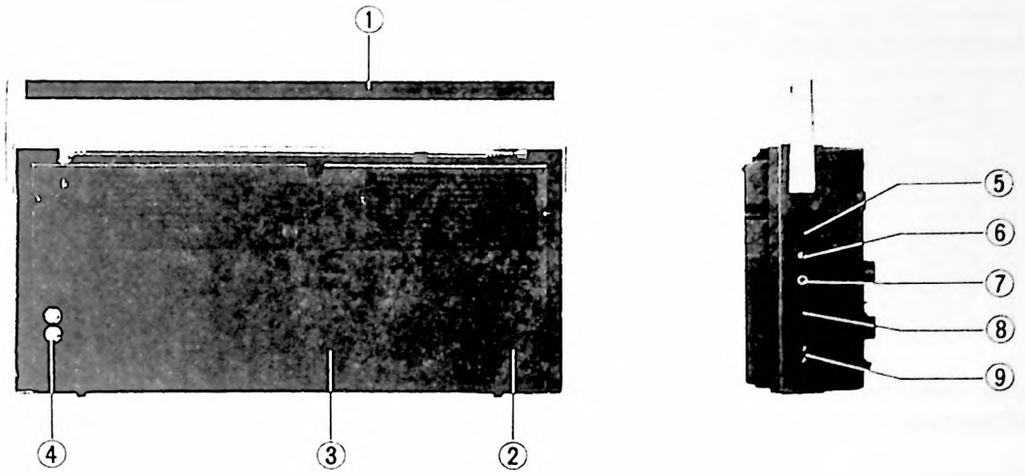
Front Side



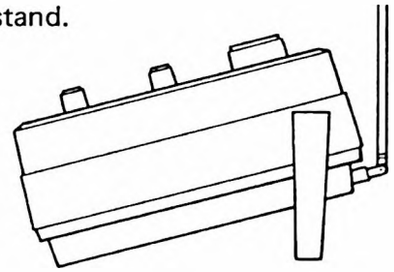
1. **STEP button**--Selects the frequency interval of scan or manual tuning. The choice is 100 or 50 kHz on FM, 1 or 3 kHz on AM.
2. **AUTO button**--Stops scanning automatically when a station is received (depends on signal level).
3. **POWER switch**--Turns your DX-400 on and off.
4. **VOLUME control**--Rotates to adjust the signal audio level.
5. **Scanning limit buttons**--Set the limits of the scanning range. Simultaneously press F1 and ENTER to register the displayed lower limit frequency; press F2 and ENTER to set the highest limit.
6. **TONE control**--Rotates to adjust the tone quality of the received signal.
7. **Enter button**--Enters frequencies into memory when pressed with a memory button. Or sets the scanning limits when pressed with F1 or F2.
8. **LIGHT/BATTERY check button**--Lights the SIGNAL STRENGTH meter and LCD display and/or checks the radio battery condition.
9. **SIGNAL STRENGTH meter**--Shows the strength of the received signal. Also shows the battery condition when one of the battery check buttons is pressed.
10. **Telescopic antenna**--Extends and adjusts for optimum reception on both AM and FM bands.
11. **SCAN button**--Starts scanning when pressed once, stops scanning when pressed again.
12. **LCD frequency displays**--Display frequency, scan mode, auto mode, frequency increment step, number of memories used, the period of sleep timer and TRY AGAIN message.
13. **RF GAIN control**--Receives distant stations when set to DX. If you're near a strong station, set to LOCAL. For medium-range signals, set to NORM.
14. **ANTenna TRIMmer control**--Adjusts the AM antenna. Rotate to get best reception on the AM band.
15. **Numeral keys**--Enter the frequency for direct tuning or setting scan limits.
16. **Band selector switch**--Selects the desired frequency band.

    FM = FM reception (87.4 – 108.00 MHz)
    AM = AM reception (150 – 29,999 kHz)
    SSB/CW = for SSB (single side band) or CW (continuous wave) reception in the AM band.
17. **SELECTIVITY button**--Reduces interference to allow best sound quality.
18. **Memory buttons**--Store and recall frequencies. Press to recall the frequency; press simultaneously with ENTER to store the frequency.
19. **SSB/CW FINE TUNING control**--Rotates to accurately tune in the SSB or CW signals.
20. **SLEEP button**--Sets the automatic shut off time.
21. **EXECUTE key**--Validates the frequency entered from keyboard.
22. **Manual tuning keys**--Advance frequency up or down by pressing UP or DOWN. For rapid tuning in AM mode, press FAST together with UP or DOWN.

Rear and left side



1. **Handle**-- Doubles as a convenient stand.



2. **COMPUTER BACKUP BATTERY compartment**--Holds two AA cells for memory backup.
3. **RADIO BATTERY compartment**--Holds six C cells for radio operation.
4. **EXTernal ANTenna and ground connection terminals**--Connect external antenna for the very best reception. ▽ terminal is for the antenna and ⏚ terminal is for the earth ground.
5. **BACKUP BATTERY CHECK button**--Checks the condition of the backup batteries.
6. **DC 12V jack**--Connects the external source of 12V DC.
7. **EXTernal SPeaker jack**--Connects to an external speaker or an earphone.
8. **Headphone Jack**--Connects a pair of headphones for private listening.
9. **AC 120V 60 Hz jack**--Connects to the supplied AC cord for AC operation. (AC220/240V 50 Hz jack for the units purchased in UK or Australia)

PREPARATION FOR USE

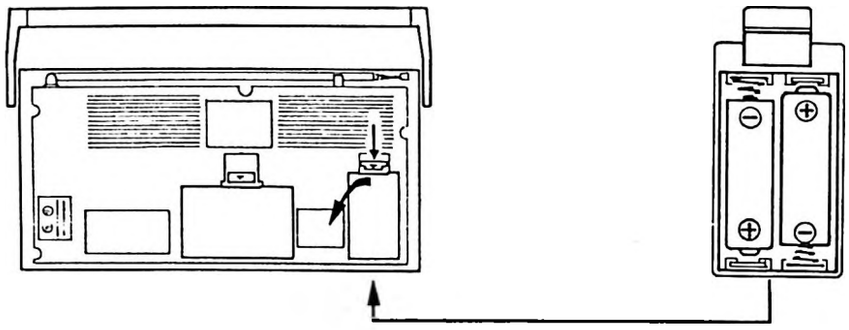
Battery Installation

You will need two sets of batteries for DX-400 operation: for radio circuitry and for built-in microprocessor. For radio operation, microprocessor batteries must also be installed.

Microprocessor Battery Installation

1. Open the COMPUTER BACKUP BATTERY compartment lid.
2. Insert two AA batteries as indicated. Observe polarity.

3. Close the lid.



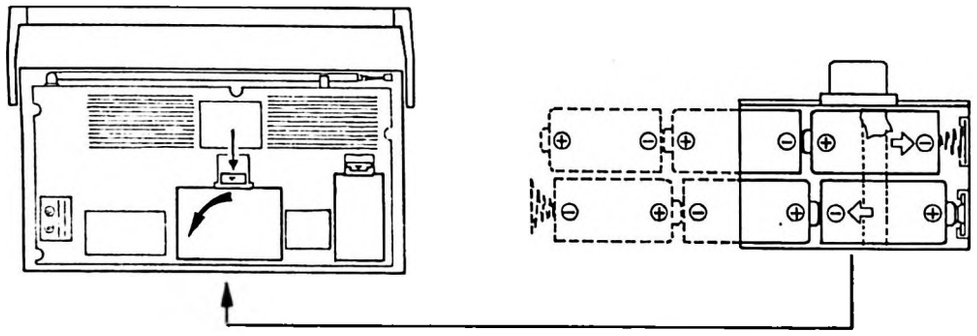
The microprocessor batteries must be replaced at least once a year. Press BACKUP BATTERY CHECK button to check the condition. If the SIGNAL STRENGTH meter reads below the E, replace batteries.

NOTE: To save the stored memories, turn the radio on and keep operating while replacing batteries.

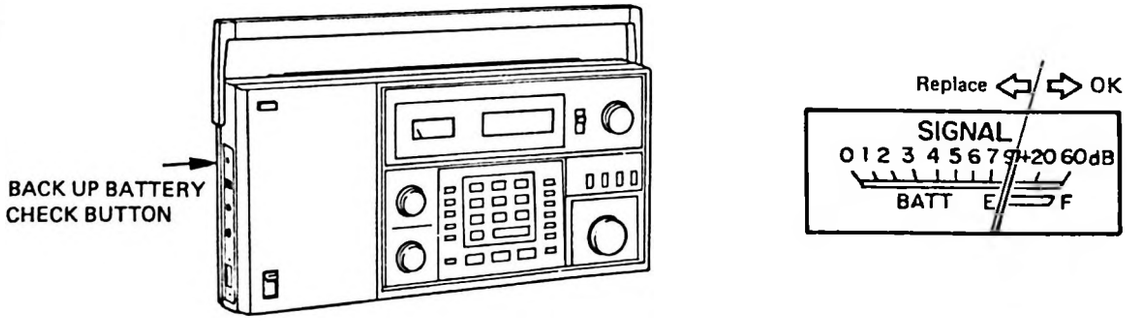
The radio circuitry is designed to operate from 9V DC or standard household AC. This power can come from internal batteries (six C cells), your vehicle battery, or the AC power cord.

Radio Battery Installation

1. Open the RADIO BATTERY compartment lid.
2. Insert six C cells as shown. Observe correct polarity.
3. Replace the lid.



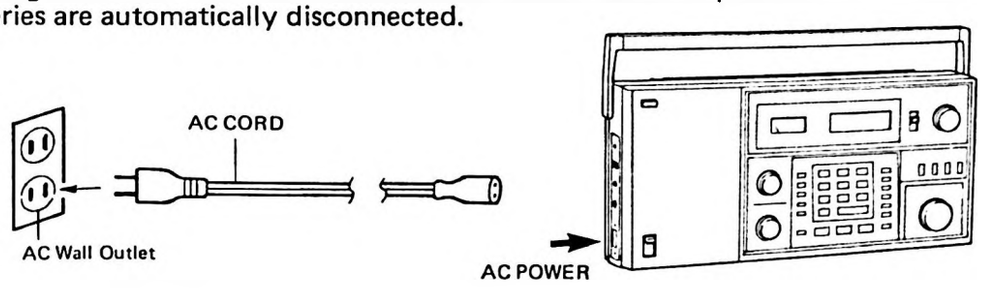
To check radio battery condition, press LIGHT/BATTERY. If the meter reading is below E, replace batteries. We recommend our 23-582 for microprocessor batteries, 23-581 or 23-551 for radio batteries.



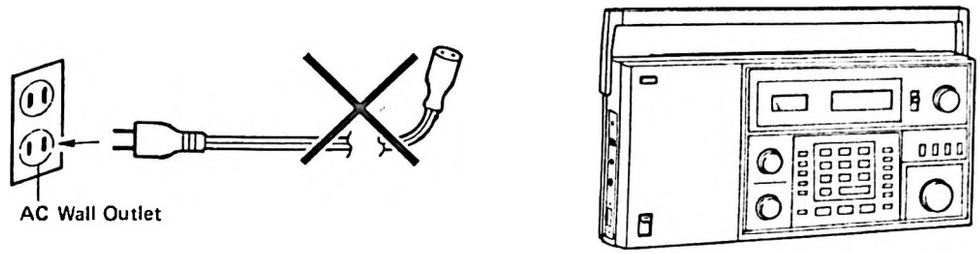
Never leave weak or dead batteries in your unit. Even so-called "lead-proof" types may leak chemicals that will damage your unit permanently.

AC Operation

You can save your radio batteries by using AC power, when available. Plug the AC power cord (supplied) into the AC 120V 60 Hz or AC 240V 50 Hz for the units purchased in UK/Australia) jack on the side of the unit and plug the other end into a standard AC outlet. When the power cord is connected to the jack, the radio batteries are automatically disconnected.

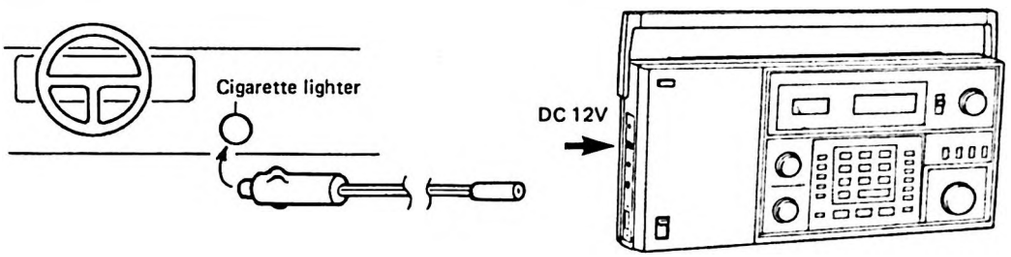


WARNING: Never leave the power cord connected to an AC outlet when the other end is removed from the AC jack on the unit. This presents a serious shock hazard.

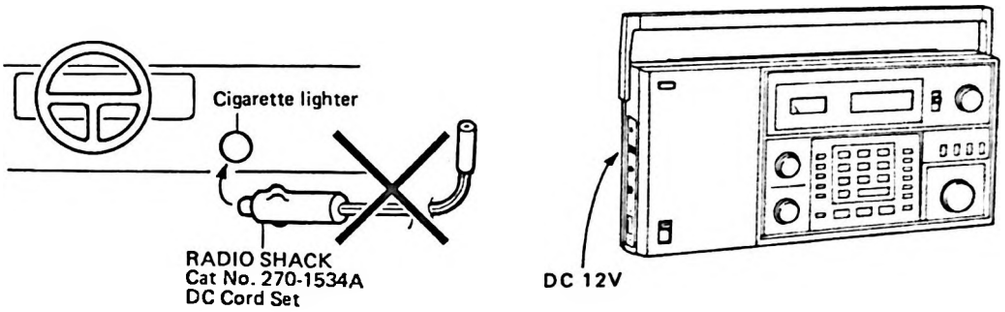


Vehicle Battery Operation

You can power the DX-400 from the cigarette lighter in your vehicle, provided it has a 12-volt, negative ground system. Use our 270-1534A heavy-duty power cord for this. Connect it to the DC 12V jack on the side of the unit and plug the other end into the cigarette lighter socket of your vehicle. Connecting this power cord automatically disconnects the internal radio batteries.



CAUTION: The 270-1534A provides 12V DC, mates properly with the jack, and has a positive center terminal. Failure to observe these points might result in damage to your unit and/or power cord/adapter. Do not let the free end of the DC power cord touch the body of the vehicle while it is plugged into the cigarette lighter socket. This could blow a fuse and damage the vehicle or cord.



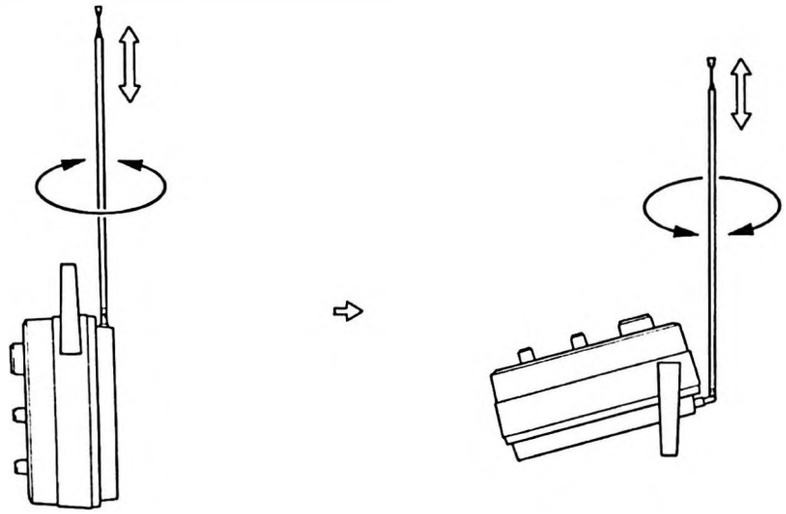
Antenna Adjustment

1. AM (LW/MW/SW) Reception

Pull the telescopic antenna out to its full length. For AM reception of 360 kHz to 2,199 kHz, the built-in ferrite bar antenna also operates. Since the bar antenna is directional, rotate your radio for best reception.

2. FM Reception

Pull out the telescopic antenna and adjust its length, angle and direction for the best reception.

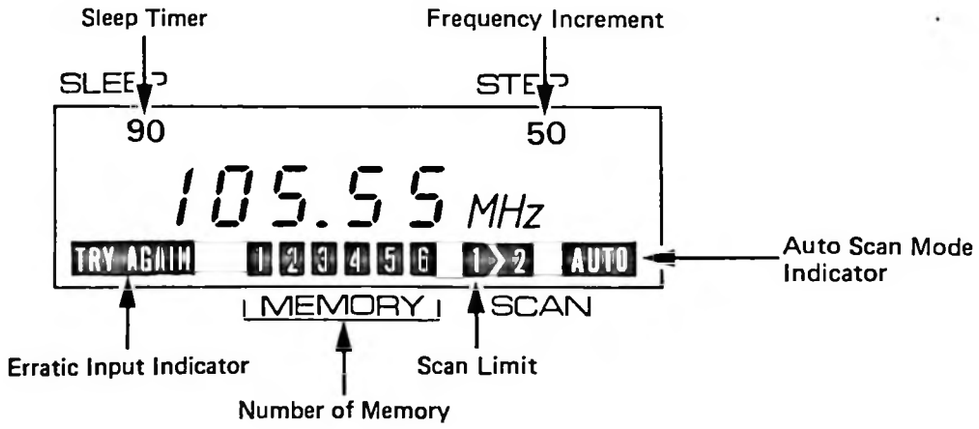


Note: Be sure to pull out the antenna fully and adjust as shown.

OPERATING DX-400

Select the power source as described previously and switch POWER to ON. You may find that meaningless figures or numbers appears on the display when you first turn the unit on (or after battery replacement). This is normal: it will soon show the factory pre-set frequency, 87.4 MHz for FM or 150 kHz for AM.

Understanding the Display



How to key in a frequency

The frequency coverage of this radio is:

FM 87.4 to 108.00 MHz
AM 150 to 29,999 kHz

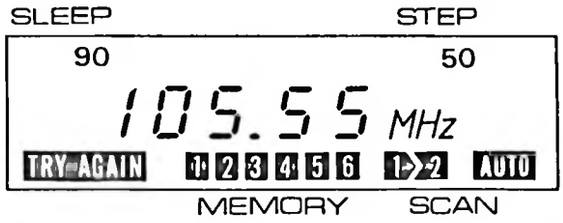
Press the numeral keys, confirm that the display shows the frequency you want to program, then press the EXECUTE key. You can now hear the station frequency you have just programmed.

Note: Press the EXECUTE key within 5 seconds after pressing the numeral keys; after 5 seconds, the frequency previously programmed will re-appear on the display (and the DX-400 is tuned to that frequency).

In case you've pressed the wrong number, press EXECUTE and key in the correct frequency.

TRY AGAIN Indicator

If you attempt to program the frequency outside the ranges your DX-400 operates on or if you've put the decimal point in the wrong place, the TRY AGAIN indicator will flash on the display. When you correct your mistake, the indicator goes off. Or, if you leave it flashing without entering a new frequency, DX-400 will return to the previous programmed frequency.



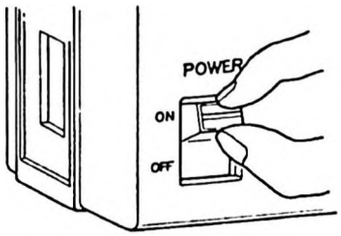
Note: For FM reception, the right end digit should be 5 or 0, otherwise the TRY AGAIN indicator will appear.

In case you're wondering. . .
. . . the tuning range of your DX-400 is permanently stored in the microprocessor chip. There's no way it can be extended or altered even by a skilled electronics technician. So if you try to enter a frequency not in the DX-400's tuning ranges, you will get TRY AGAIN every time! To listen to VHF or UHF signals, you'll need another receiver designed for that purpose.

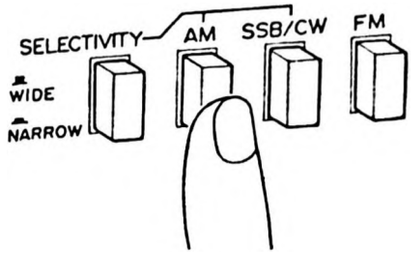
Direct Tuning

If you know the frequency of a station you are going to listen to, you can tune in the station easily by direct tuning.

1. Set the power switch to ON.



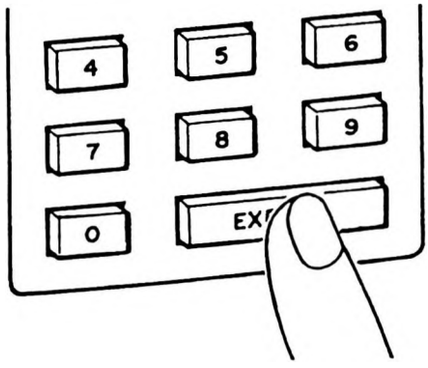
2. Select the band desired.



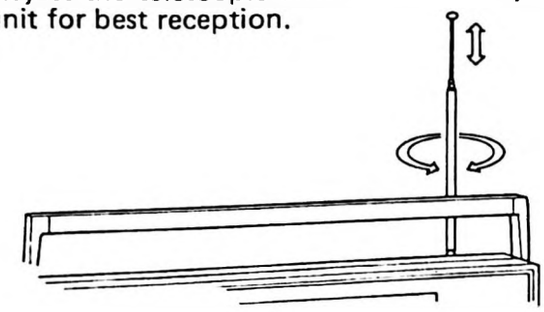
3. Key in the frequency of the station desired.

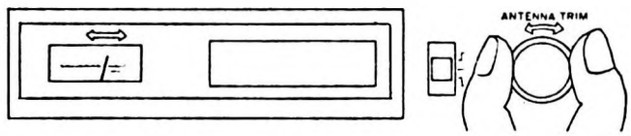
EXAMPLE: To key in AM 7,305 kHz, press the numeral keys in the order **7 3 0 5**

Then within five seconds, press the **EXECUTE** key.

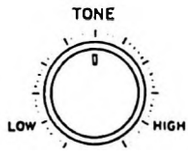


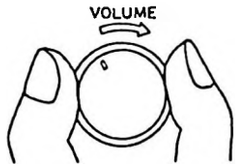
4. Adjust the telescopic antenna. For AM, also adjust the ANTENNA TRIMmer control and/or rotate the unit for best reception.





5. Adjust the VOLUME and TONE controls.

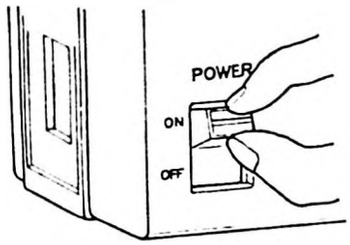




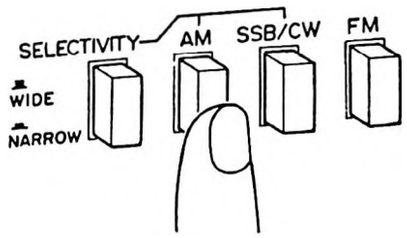
Manual Tuning

Use manual tuning when you do not know the frequency of a station you want to listen to.

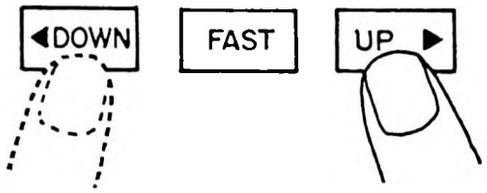
1. Set the POWER switch to ON.



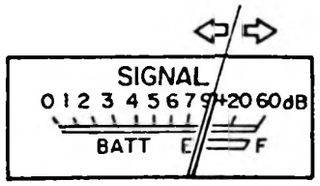
2. Select the desired band.



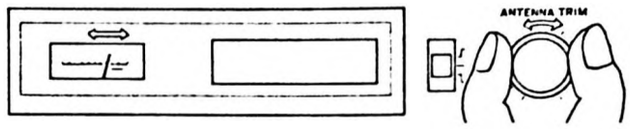
3. Press UP to advance the frequency; press DOWN for lower frequency. In AM mode, you can rapidly advance by simultaneously pressing FAST and UP or DOWN.



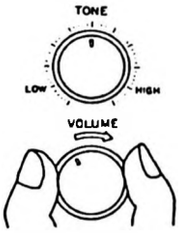
4. When you reach the desired station, release the key(s). Press UP or DOWN to get the best SIGNAL STRENGTH reading.



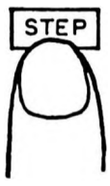
5. Adjust the telescopic antenna. For AM, adjust the ANTENNA TRIMmer control and/or rotate the unit, too.

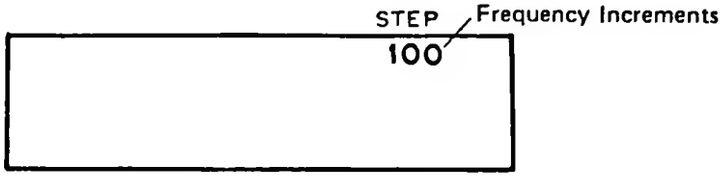


6. Adjust VOLUME and TONE.



The frequency increments can be changed by pressing STEP. Select either 1 kHz or 3 kHz on AM, 50 kHz or 100 kHz on FM. If you select 3 kHz steps, the frequency increment that appear will always be multiples of 3. Use the up or down keys to fine tune.

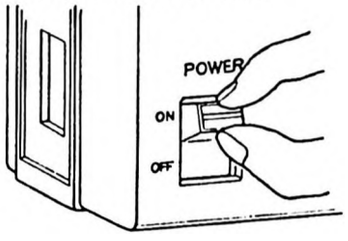




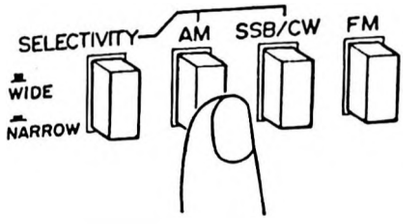
Scan Tuning

Use scan tuning to locate new stations or to monitor several broadcasts within the frequency range desired.

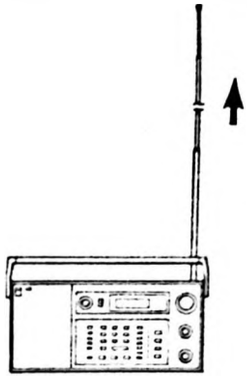
1. Turn POWER to ON.



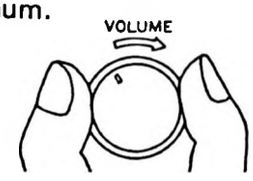
2. Select the desired band.



3. Extend the antenna fully.



4. Adjust the VOLUME control towards maximum.



5. For AM, key in the low and high limits of the frequency range you want to scan. (For FM, all the band coverage is scanned.)

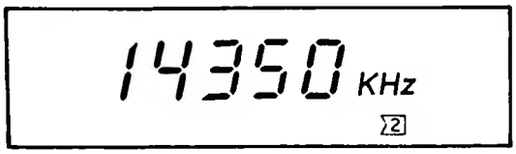
EXAMPLE: To input the frequency range of the SSB/CW 14,200 kHz to 14,350 kHz amateur 20 meter band:

a. Entering 14,200 kHz to the F1 key:

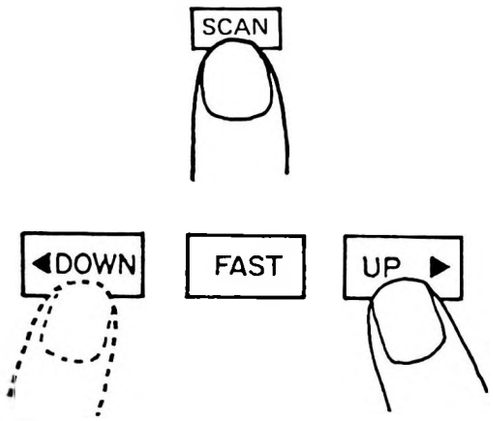
Press 1 4 2 0 0 ; press EXECUTE . Then, while pressing ENTER , press F1 . The lower limit is now set.

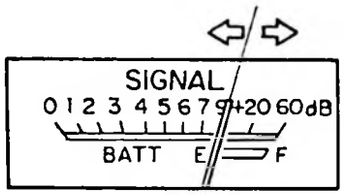
b. Entering 14,350 kHz to the F2 key:

Press 1 4 3 5 0 : press EXECUTE . Then, while pressing ENTER , press F2 . Now the DX-400 remembers the highest limit.



6. Press SCAN to start scanning. The scanning will start from the lower limit and advance. When it reaches the higher limit, scanning returns to the lower limit and starts again. When you find a station, press SCAN to stop scanning. Use the UP or DOWN key to precisely tune in the station for the highest reading on the SIGNAL STRENGTH meter.

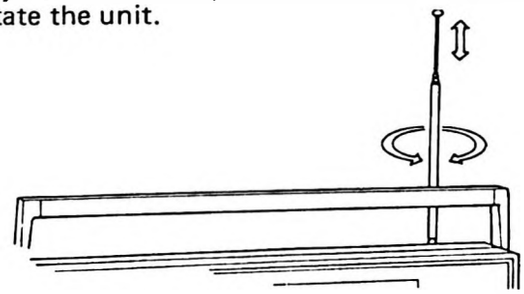


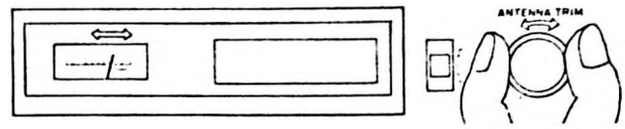


7. You can auto scan by selecting AUTO before pressing SCAN. In this mode, scanning continued as before, but automatically stops at any station above an internally preset signal level. Fine tune the station with UP or DOWN key. The display will show AUTO when the unit is in the auto mode.

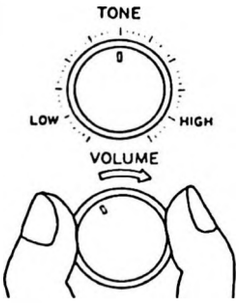
Note: Auto scanning may pick up noise (or birdies—see later selection of this manual) and stop where there is not station. It this case, press AUTO off.

8. Adjust the telescopic antenna for best reception. For AM, adjust the ANTENNA TRIMmer and/or rotate the unit.

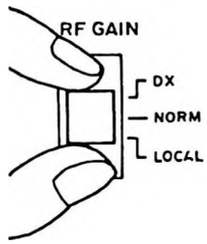




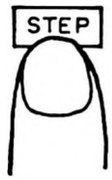
9. Adjust VOLUME and TONE controls.

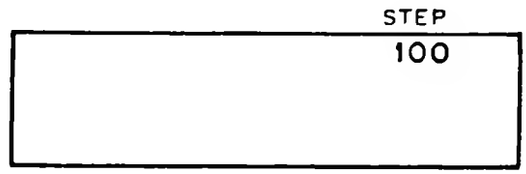


When AM reception is difficult, check that RF GAIN is set to a position other than LOCAL. And also check your ANTENNA TRIMmer.

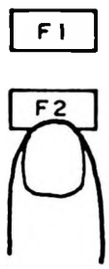


Scanning frequency increments can be selected as in manual tuning (1 or 3 kHz in AM, 50 or 100 kHz in FM).





To check the limit frequency, press F1 or F2. You can change either limit frequency independently. The last entered frequency will stay in the scan limit memories.



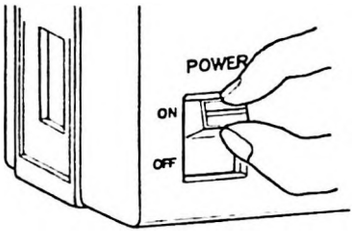
Besides scan tuning, you can tune in a station by any of there other methods-direct, manual or preset tuning. When you return to scanning after using another method, scanning begins from the frequency of the last tuned station if that station is inside the scanning frequency range.

Memory Tuning

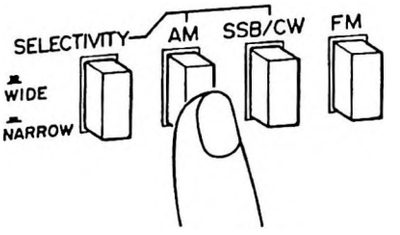
You can store a total of 12 frequencies (6 for AM and 6 for FM).

To enter into memory:

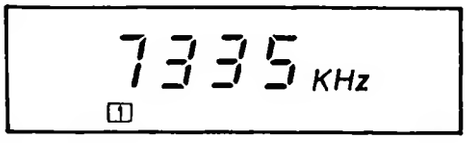
1. Switch POWER to ON



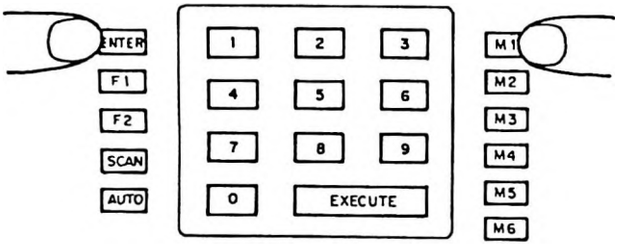
2. Select the desired band (either AM or FM).

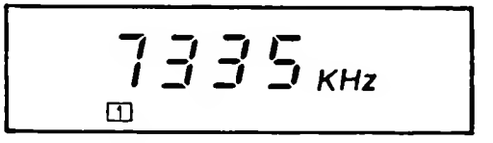


3. Tune in the station you want to store using any tuning method.

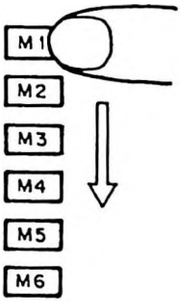


4. While pressing the ENTER key, press one of the memory buttons. Display shows the memory number in which you stored the station.

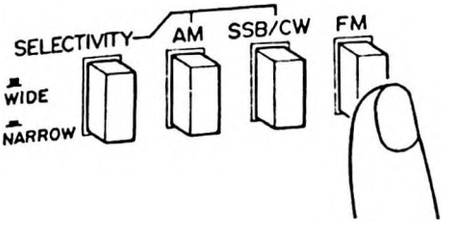




5. Repeat steps 1–4 for the other 5 memories.

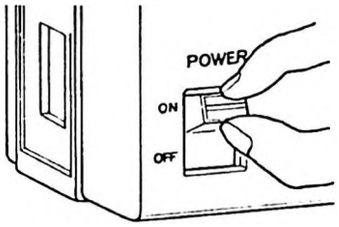


6. Change the band and repeat above for other band.

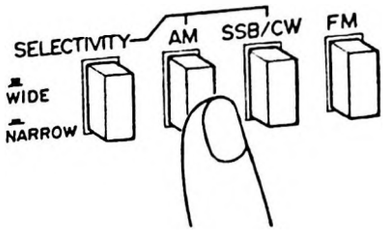


To recall memory:

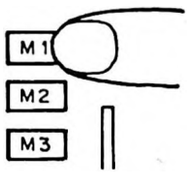
1. Turn POWER to ON.



2. Select the desired band.



3. Press the appropriate memory button. The memorized station will be tuned in.

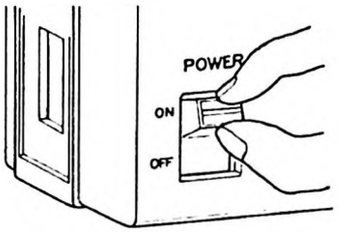


NOTE: AM 150 kHz is preset on all memory buttons at the factory. If you press a memory button where no frequency is stored, the DX-400 will tune to AM 150 kHz.

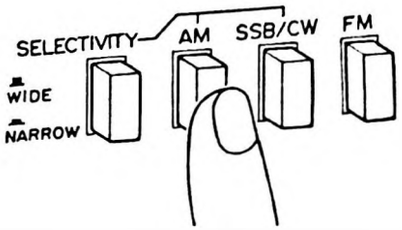
SLEEP Function

Use the sleep timer to turn the DX-400 off automatically.

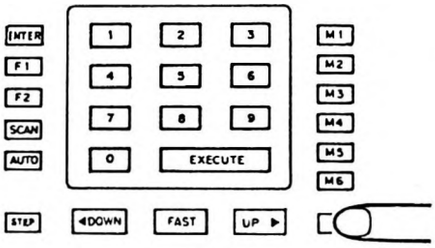
1. Set the POWER switch to ON.

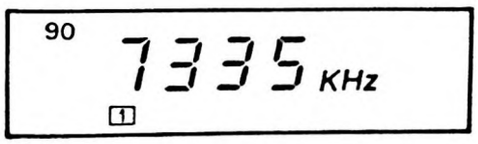


2. Tune in the desired station.

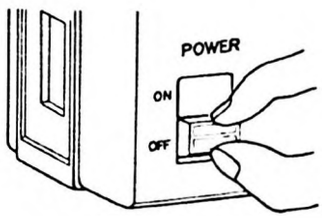


3. Press SLEEP. The display will show a maximum sleep timer count of 90 minutes. If you want less time, press SLEEP as many times as required to display your desired time. The number of minutes decreases by 10 each time you press SLEEP.





4. Set the POWER switch to off.

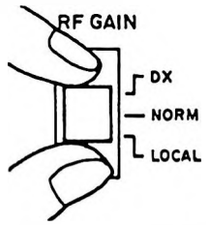


Now the DX-400 will stay on until the sleep time elapses, then it will turn off automatically. To shut off before the end of sleep time, turn POWER on once and then off. The sleep timer is cancelled and DX-400 turns off.

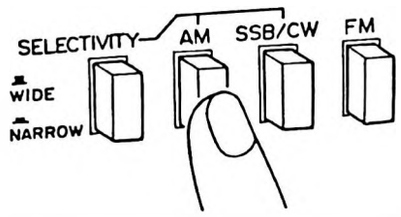
HINTS AND TIPS FOR BEST RECEPTION

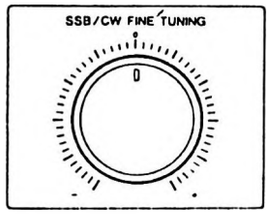
We've provided some features for the best reception.

RF GAIN adjusts the sensitivity of the receiver. For shortwave reception, set to DX (distant)—the maximum sensitivity. For midwave (the standard AM broadcast band) and long wave, the NORMAL position usually will yield best results. When receiving a weak station, set to DX. When receiving a strong signal or at night when interference is a problem, set to LOCAL.

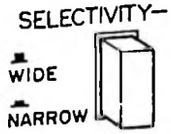


If when tuning to AM, you hear a fluttering sound (you'll be able to tell that a signal is there, but won't be able to understand anything), chances are that you are tuned to an SSB signal. Press SSB/CW button and carefully fine tune using SSB/CW FINE TUNING knob until voice sounds are normal. When improperly tuned, voices will have a low gutteral sound or will sound like "Donald Duck".

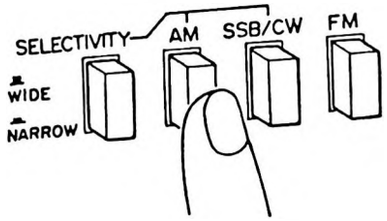




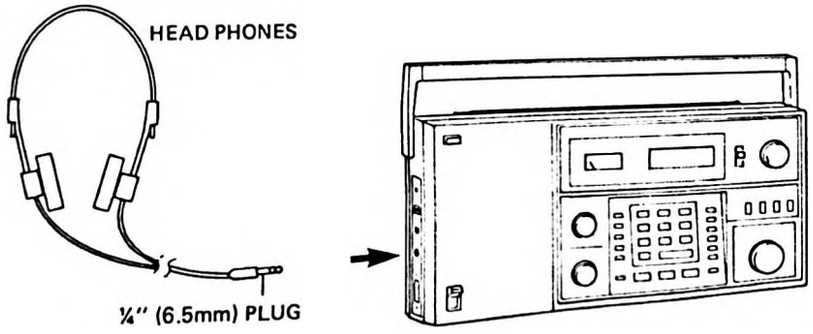
For SSB/CW reception, you may have to use the NARROW position of SELECTIVITY switch to eliminate the unwanted channel noise; this position "narrows" the audio signal to pass only the limited frequency.



If you tune through AM signals while using SSB/CW, you will hear an annoying background tone, which varies with the setting of tuning control; if this happens, press AM.



A pair of headphones is a great asset for serious shortwave listening. They make it much easier to hear and understand some of those weak and distant stations. We strongly suggest you consider purchasing a pair of communications headphones – 8 ohm impedance type. Your Radio Shack store has some good choices.



Scanning is a simple technique for quick tuning of the shortwave band. The reception conditions vary on the different bands and according to the time of day, time of year and solar activity. You won't always find the same station at the same place; sometimes certain bands will be dead while others are just jumping with activity.

Many things beyond your control affect reception to a great extent. Some are;
Atmospheric conditions – conditions of weather, solar disturbances, etc. These may make a signal come through loud and clear, or make it fade in and out, or may even block out signals completely.

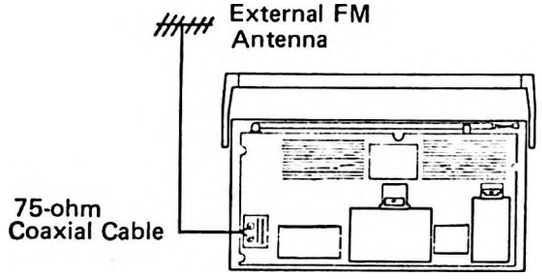
Time of the day, month and year – these greatly affect transmission of radio signals over great distances.

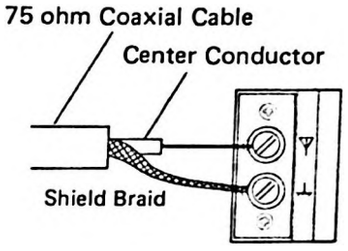
Your own skill will help to determine your success in receiving DX signals. Of course, there are a number of things you can do to improve your success – this manual gives you some suggestions. Read books and magazines, use a good antenna, and check out DX or SWL clubs.

Each of these has helpful information and ideas. Log Book is an absolute must if you intend to do much serious shortwave listening (SWL). Other places to look are some of the periodicals specializing in short-waves listening and communications. A number of fine SWL clubs and organizations can be of assistance. Also, your local library is a good source for reference and help.

ANTENNAS

An antenna is a vital part of your receiver, we've provided the telescopic antenna plus ferrite bar antenna for AM 360 kHz to 2,199 kHz. You'll find it provides acceptable reception for most signals. However, the better the antenna, the more signals you can receive–and the better you will receive them. Or when you are in a steel-frame building, a mountainous area, at a distance from the transmitter, or in a location where ignition noise is severe, you will need an external antenna. and some 30 feet of antenna wire.





For FM, you may use a set of VHF-TV rabbit ears. Those made especially for FM reception work well in suburban areas. Some deluxe models feature electronic tuning for better directionality.

An outdoor TV antenna will provide excellent FM reception. Use a splitter and you can make connections for both TV and FM from the same antenna.

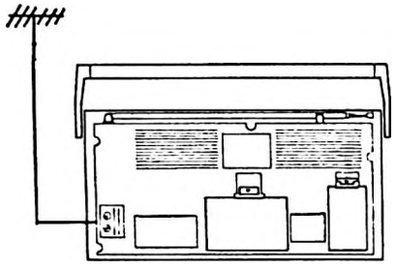
NOTE: The antennas described above are usually 300 ohm impedance. Your DX-400 antenna terminal is designed for 75 ohm types, so you will need a matching transformer. This and other accessories including the splitter are available at your local Radio Shack store.

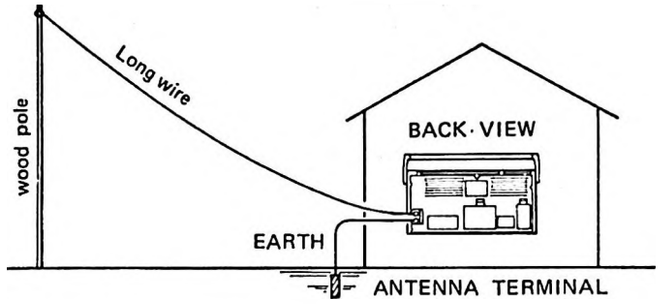
For the very best FM reception, use an outdoor antenna designed specifically for FM reception. Such an antenna can pick up stations up to 175 miles away over flat terrain.

Many modern homes and apartments have built-in 75 ohm TV/FM antenna systems and outlets. Most new color TV sets use a 75 ohm lead-in cable. In these cases, connect directly to the EXTernal ANTenna terminals. Loosen the screw, attach the braided ground wire to ⏚ terminal and center conductor to ⩛ terminal and tighten the screws.

For AM reception, many different types of antennas can be used. Unfortunately there is no single antenna which can cover the entire frequency range of the DX-400 (from 150 kHz to 29,999 kHz) with great efficiency. The 30-feet wire included will give adequate AM/short wave reception when draped across a room. Your DX-400 will also work well with 50 ohm antenna such as those designed for amateur and shortwave bands.

For a simple, all-purpose antenna, follow the illustration provided. It is important that you mount the antenna as high as possible and away from power lines, buildings and metal structures. This type of antenna will give you good reception over all of the bands. Radio Shack sells an AM/Shortwave antenna kit (catalog number 278-758).
Connect it to the ⏚ terminal.





However, if you want to obtain the best reception on one specific band, your antenna must be a certain length. Below we have listed two charts. The first chart gives an antenna length for best reception on any one band. The second chart gives the antenna length best suited for a specific ham radio band. These antenna lengths are approximately 1/2 wavelength for the band noted.

150 kHz — 500 kHz = antenna length, 1440 feet (probably too long for you to erect — you can obtain good reception even with shorter antennas)
520 kHz — 1,600 kHz = antenna length, 490 feet (see above note)
1,600 kHz — 4,500 kHz = antenna length, 153 feet
4,500 kHz — 12,000 kHz = antenna length, 57 feet
12,000 kHz — 29,999 kHz = antenna length, 22 feet
160 meter ham band = antenna length, 246 feet
80 meter ham band = antenna length, 117 feet
40 meter ham band = antenna length, 66 feet
20 meter ham band = antenna length, 33 feet
15 meter ham band = antenna length, 22 feet

If you are interested in putting up an antenna for a specific frequency, you can use the following formula to determine the 1/2 wavelength required.

Length of 1/2 wave antenna = 468,000/(Frequency in kHz)

For example: if you want to pick up International Shortwave signals specifically in the 19 meter band (15,100 kHz to 15,450 kHz). Pick a frequency in that range, such as 15,350 kHz. Using the formula:

1/2 wave antenna = 468,000/15,350 = 30.5 (feet)

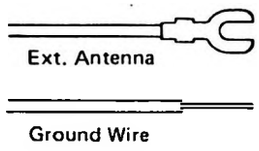
So, put up an antenna 30-1/2 feet long; that will give you best reception for the 19 meter International Shortwave band.

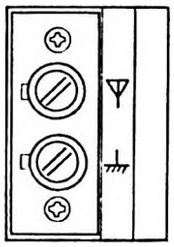
For more information about antennas, obtain a copy of THE RADIO AMATEUR HANDBOOK by ARRL.

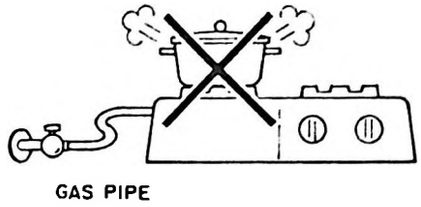
Also, for protection against lightning we urge you to use a static discharge unit on your antenna. This will protect your receiver from damage and may even protect your house from fire in case lightning strikes. You can use a TV type.

GROUNDING

To ensure best reception, you must always connect a ground wire to the ⏚ terminal. Use a heavy gauge wire for this. Connect the other end to either a metal cold water pipe (not hot water and not natural gas pipe) or to a metal rod driven into the ground. Or, you can bury a copper plate or copper screen in the ground and make a connection to it.







PROBLEMS ?

The DX-400 is a ruggedly built electronic unit with all parts conservatively rated. However, you should treat it with care; don't subject it to excessively rough handling. You will find it will give you long life if kept free from dirt and excessive humidity.

If you have problems—(we hope you don't),—check the following:

Frequency Display

No/incorrect display
* Weak microprocessor or radio batteries.
* Microprocessor fails to initialize. This may happen when you first install (or replace) batteries. Remove the microprocessor batteries, wait for about one minute, and re-install.

Display is dim
* Weak microprocessor or radio batteries.
* Environment is inappropriate for operation; temperature is too high or too much humidity.

Radio

No sound
* Check the VOLUME control setting.
* EXTernal SPeaker jack is plugged in.
* Weak radio batteries.
* AC cord not firmly plugged in.
* DC power cord is not correctly inserted into cigarette lighter socket in vehicle operation.
* AC jack or external DC jack is plugged in when trying to operate on batteries.

Weak or intermittent sound
* Weak radio batteries.
* Antenna or ANTENNA TRIMmer adjustment insufficient.
* Weak signal. Try moving the unit near a window when operating inside a vehicle or in a metal frame building.
* Tuning slightly off-frequency. Use UP or DOWN key to fine tune.

Frequency cannot be keyed in when direct tuning
* EXECUTE was not pressed within 5 seconds.
* Microprocessor failed to initialize. Remove the microprocessor batteries, wait one minute and re-install.

Scanning or memory frequency cannot be keyed in
* EXECUTE was not pressed after the frequency was keyed in.
* ENTER was not pressed simultaneously with F1, F2 or the memory buttons.

Will not scan on AM
* Limit frequencies are not keyed in.

Scanning stops where there is no clear signal

* Birdies— the internally generated signals mixed with external signals. A telescopic antenna is likely to pick up these undesirable signals; use and outdoor antenna.

A few of the most common birdies are:

455 kHz	3,844 kHz	9,000 kHz
10,245 kHz	18,000 kHz	20,490 kHz
21,835 kHz	21,868 kHz	

Scanning does not stop automatically

* Unit is not in auto mode. Check display.
* Weak signal.
* RF GAIN is set to LOCAL.
* ANTENNA TRIM improperly set.

Memorized frequency cannot be recalled

* Wrong band is set. Switch bands.
* Memory has been erased. Re-enter the frequency.

SLEEP does not function

* The POWER switch is set to ON.
* ANTENNA TRIMmer adjustment insufficient.

If none of the above suggested remedies solves the problem, return your set to your nearby Radio Shack for assistance.

BAND ALLOCATION

To avoid interference and confusion, certain portions of the radio spectrum have been set aside for specific purposes. Perhaps the most familiar example is 540 — 1600 kHz, the standard AM broadcast band.

Ham radio operators use the following bands:

160 meters = 1,800 — 2,000 kHz
80 meters = 3,500 — 4,000 kHz
40 meters = 7,000 — 7,300 kHz
20 meters = 14,000 — 14,350 kHz
15 meters = 21,000 — 21,450 kHz
10 meters = 28,000 — 29,700 kHz

International broadcasting stations have several bands set aside for them:

49 meters = 5,950 — 6,200 kHz
41 meters = 7,100 — 7,300 kHz
31 meters = 9,500 — 9,775 kHz
25 meters = 11,700 — 11,975 kHz
19 meters = 15,100 — 15,450 kHz
16 meters = 17,700 — 17,900 kHz
14 meters = 21,450 — 21,750 kHz
11 meters = 25,600 — 26,100 kHz

Note that broadcasts and hams share 7,100 — 7,300 kHz, and interference is heavy in that range.

Broadcasters in tropical regions have special bands set aside for them. In such areas shortwave is the only way to reach isolated locations:

120 meters = 2,300 — 2,495 kHz
90 meters = 3,200 — 3,400 kHz
60 meters = 4,750 — 5,060 kHz

The rest of the shortwave range is filled with marine, aeronautical and military stations. Such stations usually use either SSB or CW, and can be found outside the amateur and broadcast bands.

THE SHORTWAVE HOBBY

Shortwave listening is a hobby with thousands of participants worldwide. While no special knowledge is required for SWL, you will find your enjoyment increases with experience and special techniques for listening.

Random tuning on your DX-400 is a good idea if you've never owned a Communications Receiver before. In this way you can get acquainted with the various bands and the stations that can be heard. But after you've been listening for a while you'll discover that you can get more enjoyment by organizing your listening efforts.

Doing a little bit of library research can increase your skill as a SWL. Read up on radio propagation and theory; try to understand the conditions which make long distance reception possible. In your local library you can find such valuable references as the World Radio Television Handbook and the Radio Amateur's Handbook. Current information can be found by consulting periodicals dealing with communications and electronics.

Keep up to date on news events around the world. There's much interesting listening just tuning to the international service of a nation where an important event is taking place.

Ham radio operators can be found in the bands listed in our Band Allocations section. You'll find that hams mainly use Morse code (or CW, as they refer to it) and SSB. The ham bands are divided up into CW and SSB sections in the following manner:

3,500 – 3,800 kHz: CW
3,800 – 4,000 kHz: SSB
7,000 – 7,150 kHz: CW
7,150 – 7,300 kHz: SSB
14,000 – 14,200 kHz: CW } 20m
14,200 – 14,350 kHz: SSB }
21,000 – 21,250 kHz: CW
21,250 – 21,450 kHz: SSB
28,000 – 28,500 kHz: CW
28,500 – 29,700 kHz: SSB

These boundaries are not precisely observed everywhere in the world, so don't be too surprised to find an SSB signal in the CW portion of a band and vice-versa.

Some of the ranges where airclaft may be flying international routes use shortwave for their communications. Most transmission are in SSB, although some AM is still heard. Some of the ranges where aircraft can be heard include:

4,650 – 4,750 kHz	11,175 – 11,400 kHz
6,545 – 6,765 kHz	13,200 – 13,360 kHz
8,815 – 9,040 kHz	15,010 – 15,100 kHz
10,000 – 10,100 kHz	17,900 – 18,030 kHz

Ships and coastal stations can also be heard on shortwave. Most communications are in SSB and CW. One interesting range is 2,000 – 2,300 kHz, where the Coast Guard and many small boats can be heard. One frequency to watch is 2,182 kHz, which is an international distress and emergency channel. Other bands in which to tune for ships are:

4,063 – 4,139 kHz	12,330 – 12,420 kHz
4,361 – 4,438 kHz	13,107 – 13,200 kHz
8,195 – 8,181 kHz	16,460 – 16,565 kHz

LISTENING NOTES

If you have never tuned a shortwave receiver before, you may be a bit confused by the wide variety of signals that can be heard. To help you find your way around the bands, here is a summary of what to expect.

The 150 — 540 kHz range is known as the long wave band. You'll find reception here best at night in you location. The majority of stations use Morse code, although you will hear AM used for weather broadcasts. The largest number of stations in this range are beacons for aircraft and marine navigation. Beacons transmit their call letters continuously in Morse code at a slow speed.

A manual on air or marine navigation, available from your public library or a marine supply store, will contain lists of these beacons and their locations. Weather broadcasts on AM often identify themselves by their location instead of by call letters (such as "New Orleans Radio"). Many ship stations also use this range, with 500 kHz set aside by international agreement for distress and emergency calls.

International broadcast stations can be found in the bands indicated in our section on Band Allocations. Many such stations operate in English, and often can be heard during the evening hours (between 6:00PM and Midnight, your local time). Programming usually consists of news, commentaries, local music, and features on life in their respective countries. Among the stations that are listener favorites worldwide are Radio Japan, the British Broadcasting Company, Israel Radio, Radio Nederland in Holland and Radio Australia. You'll soon discover which stations will be your personal favorites.

In tropical areas of the world, static makes reception on the standard AM broadcasting band very difficult. This has resulted in special Tropical Bands set aside for nations located in tropics. Programming here is intended for local audiences and much of what can be heard is a treat — exotic languages, beautiful and unusual music, etc. Some English can be heard, however, from stations in Africa or the Pacific.

You'll find time standard stations quite useful. These stations give out the exact time of day at specified intervals. The National Bureau of Standards operates station WWV in Fort Collins, Colorado on 2,500, 5,000, 10,000, 15,000, and 20,000 kHz. A man's voice gives the time each minute along with periodic reports on shortwave reception conditions. The National Bureau of Standards also operates another station, WWVH, on the same frequencies as WWV, in Hawaii. WWVH uses a woman's voice to give the time. Sometimes you can hear these two stations simultaneously. Other time standard stations are Canada's CHU on 3,330, 7,335 and 14,670 kHz and VNG in Australia on 4,500 and 12,000 kHz. Several other nations have similar stations.

FREQUENCY CONVERSION

Your Communications Receiver is calibrated in Megahertz (MHz) and Kilohertz (kHz) — as most communications-type receivers are. You should be familiar with these terms:

Megahertz: Millions-of-hertz (or cycles-per-second). A Megahertz is 1,000,000 hertz (Hz for short) or 1,000,000 cycles-per-second. Mega means million.

Kilohertz: Thousands-of-hertz. A kilohertz is 1,000 hertz. We use the abbreviation kHz. Kilo means thousand.

Meter: The term meter, as applied to shortwave listening, refers to the wavelength of a radio frequency. In many parts of the world, frequencies are listed in meters, for example, international shortwave stations in the 19 Meter band. European radio equipment and stations often refer to the wavelength of a station or band (in meters), rather than frequency (in MHz or kHz).

The relationship of these three terms is:

1 MHz (million) = 1,000 kHz (thousand)

To change 9.62 MHz to kHz, we multiply by 1000.

$9.62 \times 1000 = 9620$ kHz

To go the other way, from kHz to MHz, divide by 1000. A station at 3780 kHz is

$$\frac{3780}{1000} = 3.780 \text{ MHz}$$

To convert MHz to meters, use this formula:

$$\text{Meters} = \frac{300}{\text{MHz}}$$

Example: What is the wavelength of 7.1 MHz?

$$\frac{300}{7.1 \text{ MHz}} = 42.25 \text{ meters}$$

COUNTRY LOG

The following listing contains some of the more frequently heard stations on shortwave. The stations listed can be heard throughout the North American Continent. All stations operate in English unless otherwise specified. Most of these stations do not broadcast continuously.

Obviously, reception will vary on the different frequencies according to the time of day and season of the year. Remember that reception from different parts of the world varies with the time of day and the frequency to which your DX-400 is tuned. Consult the section on Changes in Reception for a more detailed explanation of these variations.

Remember also that the 7,000–7,300 kHz range is shared by hams and international broadcasts; consequently, interference is severe in that range.

While every effort has been made to ensure the accuracy of this list, stations can and do change frequencies. Check periodicals on communications and electronics for more current information on station frequencies and schedules.

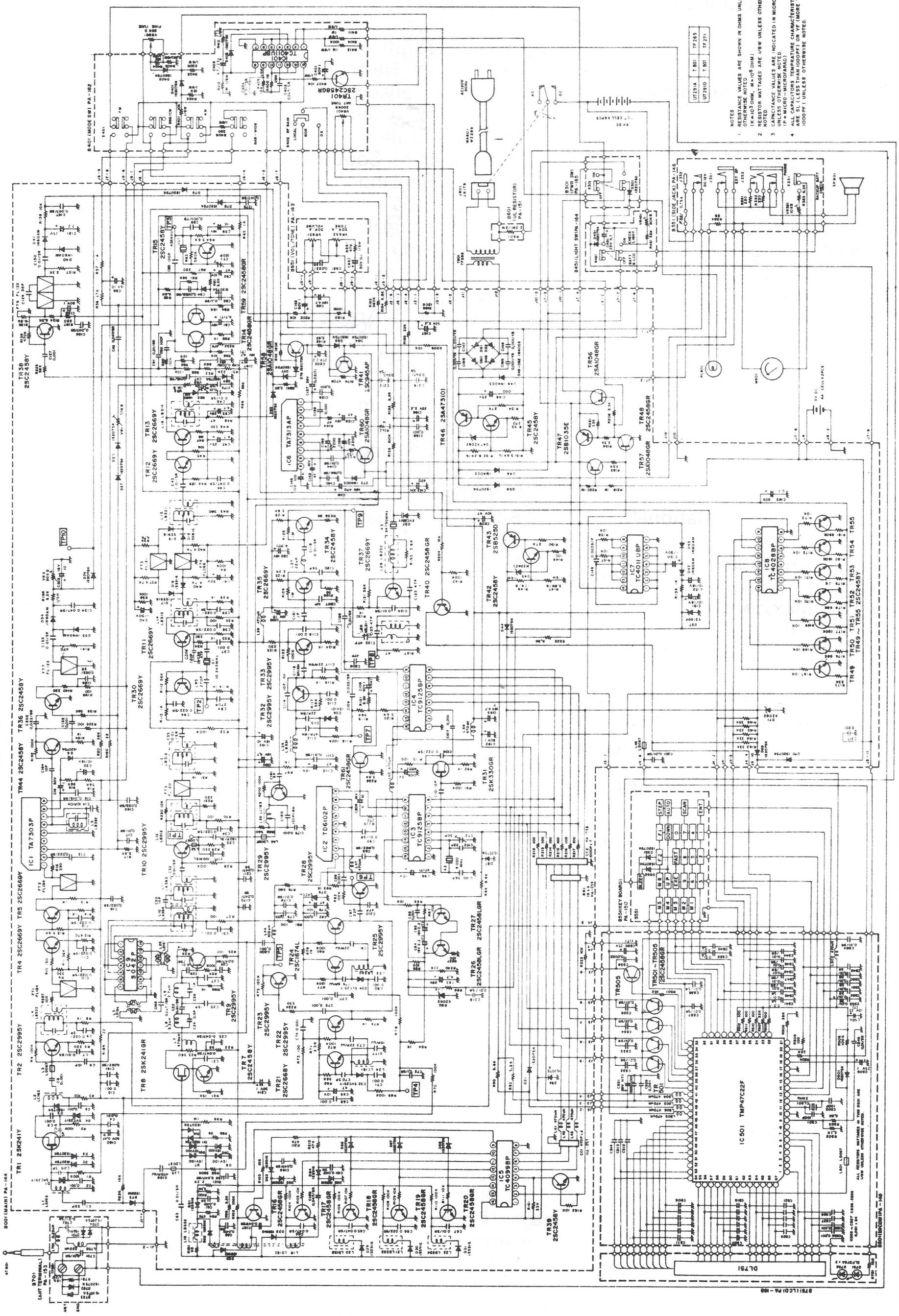
This list only contains broadcasting stations which operate on fixed frequencies with regular schedules. Ham, military, marine and aeronautical stations operate on varied frequencies with irregular schedules.

These listings can change at any time and are here for your reference only. No attempt has been made to provide an accurate up-to-date listing. For a yearly up-to-date listing, check the world radio television hand book.

kHz	STATION	LOCATION	REMARKS
3,223	Radio SR	Swaziland	
3,265	Radio Mozambique	Maputo, Mozambique	Programs in Portuguese
3,300	Radio Cultural	Guatemala City, Guatemala	Religious Programs
3,380	Radio Iris	Esmeraldas, Ecuador	Programs in Spanish
3,385	FR3	Cayenne, French Guiana	Programs in French
3,396	Radio Kaduna	Kaduna, Nigeria	
4,750	Radio Bertoua	Bertoua, Cameroon	
4,755	Imo Regional Radio	Imo, Nigeria	
4,777	Radio-TV Gabon	Libreville, Gabon	Programs in French
4,795	Radio Nueva America	La Paz, Bolivia	Programs in Spanish
4,820	Radio Paz y Bien	Ambala, Equador	Programs in Spanish
4,832	Radio Reloj	San Jose, Costa Rica	Programs in Spanish
4,855	Radio Clube do Para	Belem, Brazil	Programs in Portuguese
4,890	National Broadcasting Commission	Port Moresby, Papua New Guinea	
4,915	Voice of Kenya	Nairobi, Kenya	
4,920	Australian Broadcasting Commission	Brisbane, Australia	
4,945	Radio Colosal	Neiva, Colombia	Programs in Spanish
4,965	Radio Santa Fe	Bogota, Colombia	Programs in Spanish
4,980	Ecos del Torbes	San Cristobal, Venezuela	Programs in Spanish
4,990	Radio Barquisimeto	Barquisimeto, Venezuela	Programs in Spanish
5,020	Solomon Islands Broadcasting Service	Honiara, Solomon Islands	
5,057	Radio Gjirokaster	Gjirokaster, Albania	Programs in Albanian
5,950	Guyana Broadcasting Service	Georgetown, Guyana	
5,954	Radio Casino	Puerto Limon, Costa Rica	
5,960	Radio Canada International	Montreal, Canada	
5,980	Radio RSA	Johannesburg, South Africa	
6,005	CFCX	Montreal, Canada	
6,025	Radio Malaysia	Kuala Lumpur, Malaysia	Programs in Chinese
6,045	Radio Australia	Lyndhurst, Australia	
6,055	Nihon Shortwave Broadcasting Company	Tokyo, Japan	Programs in Japanese
6,060	Radio Nacional	Buenos Aires, Argentina	Programs in Spanish
6,075	Radio Sutatenza	Bogota, Colombia	Programs in Spanish
6,090	Radio Luxembourg	Ville Louvigny, Luxembourg	
6,095	Polskie Radio	Warsaw, Poland	
6,105	Radio New Zealand	Wellington, New Zealand	
7,140	Trans World Radio	Monte Carlo, Monaco	
7,170	Radio Noumea	Noumea, New Caledonia	Programs in French
7,300	Radio Tirana	Tirana, Albania	
9,475	Radio Cairo	Cairo, Egypt	
9,515	Voice of Greece	Athens, Greece	
9,525	Radio Korea	Seoul, South Korea	
9,530	Spanish Foreign Radio	Madrid, Spain	
9,535	Swiss Radio International	Berne, Switzerland	
9,540	Radio Prague	Prague, Czechoslovakia	
9,570	Radio Bucharest	Bucharest, Rumania	
9,575	Italian Radio and Television Service	Rome, Italy	
9,610	Radio-TV Algeria	Algiers, Algeria	Programs in Arabic
9,620	Radio Berlin International	Berlin, East Germany	
9,645	Radio Norway	Oslo, Norway	
9,720	Radio Iran	Tehran, Iran	Programs in Farsi
9,745	HCJB	Quito, Equador	
9,770	Austrian Radio	Vienna, Austria	
9,800	Radio Kiev	Kiev, USSR	
9,835	Radio Budapest	Budapest, Hungary	
10,040	Voice of Vietnam	Hanoi, Vietnam	
11,655	Israel Radio	Jerusalem, Israel	
11,690	Radio Kuwait	Kuwait, Kuwait	
11,705	Radio Sweden	Stockholm, Sweden	
11,720	Radio Moscow	Moscow, USSR	

kHz	STATION	LOCATION	REMARKS
11,735	Radio Sofia	Sofia, Bulgaria	
11,745	Voice of Free China	Taipei, China	
11,815	Radio Japan	Tokyo, Japan	
11,825	Radio Tahiti	Papeete, Tahiti	Programs in Tahitian
11,835	4VEH	Cap Haitien, Haiti	
11,845	Radio Canada !nternational	Montreal, Canada	
11,850	Deutsche Welle	Cologne, West Germany	
11,890	Voice of Chile	Santiago, Chile	
11,900	Radio RSA	Johannesburg, South Africa	
11,910	BBC	London, England	
11,930	Radio Havana Cuba	Havana, Cuba	
11,935	Radio Portugal	Lisbon, Portugal	
11,945	Radio Peking	Peking, China	
11,955	Voice of Turkey	Ankara, Turkey	
11,980	Radio Moscow	Moscow, USSR	
15,038	Saudi Arabian Broadcasting Service	Riyadh, Saudi Arabia	Programs in Arabic
15,084	Voice of Iran	Tehran, Iran	Programs in Farsi
15,135	Radio Moscow	Moscow, USSR	
15,165	HCJB	Quito, Ecuador	
15,190	ORU	Brussels, Belgium	
15,205	All India Radio	New Delhi, India	
15,260	BBC	London, England	
15,265	Finnish Radio	Helsinki, Finland	
15,275	Radio Sweden	Stockholm, Sweden	
15,305	Swiss Radio International	Berne, Switzerland	
15,310	Radio Japan	Tokyo, Japan	
15,320	Radio Australia	Melbourne, Australia	
15,400	BBC	London, England	
15,430	Radio Mexico	Mexico City, Mexico	Programs in Spanish
15,465	Radio Pakistan	Islamad, Pakistan	Programs in Urdu
17,720	Radio France International	Paris, France	
17,825	Vatican Radio	Vatican City	
17,860	Austrian Radio	Vienna, Austria	
21,495	Israel Radio	Jerusalem, Israel	
21,525	Radio Australia	Melborne, Australia	
21,625	Israel Radio	Jerusalem, Israel	
21,645	Radio France International	Paris, France	
21,735	Radio-TV Morocco	Rabat, Morocco	Programs in Arabic
25,650	BBC	London, England	
25,790	Radio RSA	Johannesburg, South Africa	

SCHEMATIC DIAGRAM



RADIO SHACK LIMITED WARRANTY

This product is warranted against defects for 1 year from date of purchase from Radio Shack company-owned stores and authorized Radio Shack franchisees and dealers. Within this period, we will repair it without charge for parts and labor. Simply **bring your Radio Shack sales slip** as proof of purchase date to any Radio Shack store. Warranty does not cover transportation costs. Nor does it cover a product subjected to misuse or accidental damage.

EXCEPT AS PROVIDED HEREIN, RADIO SHACK MAKES NO WARRANTIES, EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Some states do not permit limitation or exclusion of implied warranties; therefore, the aforesaid limitation(s) or exclusion(s) may not apply to the purchaser.

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